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EXECUTIVE SUMMARY OF DAVID GRANICK'S REPORT:
"SOVIET INTRODUCTION OF NEW TECHNOLOGY:
DEPICTION OF THE PROCESS"

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This Informal Note is an Executive Summary of David Granick's study of the difficulties involved in introducing new technology into civilian industry in the USSR. Dr. Granick is a Consultant to the SSC and Professor of Economics at the University of Wisconsin. The study is a subtask of SRI/SSC's National Security Policy Research Project and a part of the Soviet and Comparative Economics Program headed by M. Mark Earle, Jr., Senior Economist and Assistant Director, and Dr. Herbert S. Levine of the University of Pennsylvania, Senior Research Consultant.

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I INTRODUCTION AND SUMMARY

This report discusses the problems involved in the introduction of new technology, developed domestically or imported from abroad, into civilian industry in the Soviet Union. The main concentration of the report is on the issue of incentives. A qualitative model is constructed to depict the forces at work in the USSR in regard to the assimilation of new technology particularly at the level of the industrial enterprise. These forces and their effects are analyzed in depth. A comparison is then undertaken with the German Democratic Republic, another centralized socialist economy, but one where the process of new technology assimilation has been more successful. A model for East Germany is described and is contrasted with the Soviet model. Major emphasis is laid on the different managerial philosophies employed in the two economies.

The modeling of the reward-punishment nexus and its role in technology diffusion in the Soviet Union and in East Germany comprises the main focus of the paper, but several other issues are also explored; *including:*

- The existence and nature of technology lag in the Soviet Union;
- Disproportions among the necessary elements in the chain leading from basic research to the process of implementation in the form of new products or processes;
- The difficulty of procuring useful information on new technology developed and being developed abroad.
- The organizational issue of the degree to which research, development and production should be carried out within distinct organizations.

The paper carefully analyzes the elements involved currently in the Soviet incentive mechanism which lead to Soviet difficulties in absorbing new technology. In this way the paper contributes to the U.S. policymaker's ability to evaluate possible future changes in the operation of the Soviet system. It points out what features of the system are central to the

technology absorption problem, and thus what will have to be altered in order for real change in performance to be achieved. A commonly held approach in the West is to explore the elements of the Soviet incentive mechanism and to indicate which specific elements need to be changed in order to achieve improvement. This paper argues that changes in specific incentive elements will yield, at best, limited improvement. What is necessary is to change the basic managerial philosophy, to move from making managerial income and promotion rewards direct and immediate functions of measurable objective performance indicators to a system where these rewards are decided upon by superiors, using subjective evaluation criteria. This is the system used in East Germany and in many capitalist economies including the United States. Further, it is argued that Soviet leaders could adopt this approach without doing violence to their socio-political beliefs and without running the major economic and political risks of radical economic reform.

These conclusions comprise an original contribution to the analysis of the absorption of new technology in the Soviet Union. To the extent that they stand up under critical review, they should significantly affect the U.S. policymaker's assessment and forecast of the performance of the Soviet economy.

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II ORGANIZATIONAL ISSUES IN SOVIET ABSORPTION OF NEW TECHNOLOGY

All countries find the process of implementing new technological developments to be difficult and painful. In Chapter II of the report, the dimensions of Soviet problems in this regard are discussed. Evidence is presented to show that Soviet difficulties in this area are significant and more severe than those found normally in advanced market economies. While new products are introduced into production on a fairly wide scale, these new products are not as frequently successful improvements over the old as is found in other countries. Furthermore, there is a clearly observed unwillingness on the part of Soviet managers to produce new products which involve major changes from the status quo; new products in the Soviet Union overwhelmingly involve only minor changes.

The introduction of new processes of production in Soviet industry, it can be argued, is met with less opposition from Soviet managers than is the introduction of significantly new products. While data on this issue are hard to come by, some evidence is presented in Chapter II in support of this view.

Chapter III deals with the chain of activities leading from basic research to the actual introduction of new products and processes. The effective use of research and development inputs in any economy is heavily conditioned by the degree to which there is appropriate balance in the chain from basic research to the successful production and marketing of new products, and introduction of new processes. An overly heavy balance on the early links of the chain can be wasteful, for it results in insufficient devotion of resources and effort to those activities concerned directly with the introduction of successful innovation into production. Just such a problem is indicated in Soviet practice. Compared with the United States and other Western countries, the Soviet Union devotes relatively more resources to research-type activities and less to development-type activities. Moreover, the proportion of personnel in the Soviet Union

involved in development activities fell relative to the proportion in research activities in the late sixties and early seventies.

New processes of production are frequently "embodied" in newly installed equipment, i.e., they are introduced through investment in fixed capital. Since the rate of investment in Soviet industry is high by international standards, it might be thought that this would give the Soviet Union an edge in the introduction of new processes. However, this does not appear to be the case. For one thing, the rate of replacement of old equipment by new is not very high in the Soviet Union. And secondly, the combination of long construction periods for factories and their lengthy running-in periods leads to the situation that production facilities which may have originally been designed with modern equipment and processes are partially obsolete by the time they begin to produce at their designed production level.

Chapter IV is concerned with the ways in which the international transfer of technology is accomplished. One way is through the purchase of an example of the new product. This, however, is not too effective, for it often requires great effort to duplicate the technology even with the product in hand. A second method is through published information and the purchase of blueprints. This, also, is not too effective. The most effective means to transfer foreign technology is through the transfer of people. A country seeking to acquire foreign technology can send its technologists abroad to study foreign technology and production and management methods; or it can import foreign technologists with the foreign technology. The most effective way of accomplishing the latter is through joint ventures. The potential profit of the foreign firm is greatest when it has an equity stake in the activity, and under such conditions it is more willing to involve its best people in the transfer of the technology.

The Soviet Union has so far concentrated its efforts on the two least effective means of technology transfer: products and publications. They have been reluctant either to send large numbers of their own engineers abroad or to bring in large numbers of foreign engineers. They

have, however, involved a good number of foreign specialists in the development of the Tol'iatki auto plant and the Kama River truck plant. They have been reluctant to grant equity interests in enterprises within the Soviet Union to foreigners, though they have developed joint ventures wherein the foreign firm has agreed to take the profit in the form of output produced by the plant constructed in the Soviet Union. And finally, while they have engaged in the purchasing of foreign licenses, it is not clear that the foreign firms have been willing to send their best people to the Soviet Union to service these licenses in the absence of an equity interest in the activity.

Chapter V discusses the form of organization of the research and development chain in the Soviet Union compared with other countries. The basic issue involves the separation or integration of the links in the chain. In the United States, applied research, development, design and production are normally integrated into a single business organization. The advantages of such integration are well recognized. Applied research can be most readily geared to the production, marketing, and financial capabilities of the organization which will be the user, if this research is carried on within the bounds of the organization. There are also, however, purported disadvantages to integration. Some claim that with R&D tied closely to production, R&D which might not lead to production by that firm is avoided. This reduces the possibility of significant innovation. Furthermore, there are aspects of the managerial incentive system in Soviet industry which militate against integration of R&D and production.

Soviet leaders, at least until the recent period, seem to have been more impressed with the disadvantages than with the advantages of integration. On the whole, they have preferred to establish a separate organization to handle each function in the research-to-production chain. Figure 1 lists the organizations specializing in different parts of the process.

The paper sketches out, with some detail, the various organizations involved and their work.

Figure 1

**ORGANIZATION OF THE SOVIET RESEARCH AND
DEVELOPMENT PROCESS**

<u>Organizations</u>	<u>Main Activity</u>
Academy of Sciences of the USSR, institutes	Basic research
Academies of Sciences of the republics, institutes	Basic and applied research
Universities and other higher educational institutes	Presumably, applied research with some basic research
R&D institutes under the jurisdiction of the indus- trial ministries	Applied research and advanced development work
Design institutes and bureaus under the jurisdiction of the industrial ministries	Engineering design of new products and processes, parti- cularly where such design serves the needs of more than one enterprise
Development and design sec- tions included within the compass of production enter- prises	Minor development, design, and testing work intended to serve only the needs of the individual enterprise

Beginning about 1964, ob'edineniia or associations of enterprises began to be formed again (they were used in the 1920s, but were dropped in the early 1930s). And in 1968, scientific-production associations began to be formed. These are composed of at least one R&D institute, with engineering design subdivisions, and production enterprises intended to put the newly developed products into batch production. The associations were greatly strengthened by government legislation in the spring of 1974. Clearly, these scientific-production associations represent a potentially significant organizational break in the R&D production chain. Whether they will live up to this potential remains to be seen.

III THE GENERAL MODEL OF SOVIET MANAGERIAL BEHAVIOR AND THE ASSIMILATION OF NEW TECHNOLOGY

In Chapters VI-VIII, the paper sets out a general model of Soviet managerial behavior and discusses its effects on the assimilation of new technology in Soviet industry.

In any organization, a fundamental problem for the policymakers is to develop a managerial environment which will cause managers at various levels in the system to take those implementing decisions most in line with the objectives of the top policymakers. One approach to this motivational problem is to create an atmosphere in which subordinate managers will internalize the welfare function of the leaders. Such internalization has been pursued in the Soviet Union through political indoctrination and through Communist Party supervision over enterprise managers. But Soviet leaders have never had much confidence in their ability to create such an atmosphere, certainly not with regard to the detailed and changing components of central policy. Instead, they have viewed industrial managers as "economic men," and have attempted to create a combined incentive and decision-rule system which would lead such managers, in their own personal and narrow self-interest, to act in a fashion desired by the central policymakers.

The report focuses on the reward-punishment nexus created for managers, with particular attention to top management of the industrial enterprise (since top management plays the key role in the assimilation of new technology at the enterprise level). This nexus has four major components: (1) career changes, (2) bonuses received by top management, (3) size of enterprise bonus fund, and (4) size of enterprise wage fund.

It might be expected that the principal incentive for top managers would be the securing of promotion and avoidance of demotion. During the prewar period in the Soviet Union, career movement was sufficiently rapid so that this was probably the case. But since the mid-fifties, managerial

stability has been extensive, considerably greater, for example, than that in large American industrial firms.

In this situation of clogged managerial lines, bonuses take on particular importance as a managerial incentive. Bonuses, in the Soviet Union, are large relative to managerial salary, currently running about 30 percent of managerial income. And what seems internationally unique, they are paid to all managerial levels including the lowest, they are paid for results over very short periods (leading to substantial fluctuations in managerial income), and they are linked, even for top managers, to quantitative indicators of success rather than to subjective evaluations of performance.

Though it might be argued that top managers are primarily concerned with their own individual bonuses, in reality they can be thought of as trying to maximize some time-discounted sum of bonus earnings of their enterprise. Partly this is because of the close relationship between top managers' own bonus earnings and the bonus fund of the enterprise. But also it is because the earnings of their managerial and professional staff depend heavily upon the size of the fund, and thus a high bonus fund is vital if the enterprise is to keep its more competent staff from moving to other enterprises. Similarly, top managers must be concerned with the size of the enterprise wage fund, for manual workers are paid largely according to piecework, and workers' bonuses, a substantial part of their income, are mainly paid out of the wage fund. Thus, an insufficient wage fund would lead to a high quit rate of the more competent and mobile workers.

The enterprise bonus fund is created as a weighted function of several success indicators. But the bonuses paid to top management are, according to the regulations, reduced to zero if any one of a specified set of success indicators falls below the planned level. The following model depicts the objective function of enterprise top management:

maximize: $G = f(\sum_1^M a_i I_i)$

subject to:

$I_j \geq \bar{I}_j$ ("full constraints")

$I_k \geq \bar{I}_k$ ("minor constraints")

where:

G = objective function of enterprise top management

I = success indicator, achieved

\bar{I} = success indicator, planned

a_i = weight of the i^{th} success indicator in determining the bonus fund

sets i and j are intersecting sets

set k is disjoint from sets i and j

The maximized function above refers to the particular success indicators (I_i) whose weighted average determines the size of the bonus fund for a given period. The set of "full constraints" (I_j) includes those success indicators whose fulfillment by less than 100 percent leads to sharp reduction in the enterprise bonus fund and/or to elimination of bonus earnings by the enterprise's top management. "Minor constraints" refers to those success indicators (I_k) which may affect the future career prospects of individual top managers, but have only an insignificant effect on the size of the enterprise bonus fund.

When this one-period model is expanded to a multiperiod one, the following elements in the model are observed:

- (1) Managers seek to maximize discounted future bonuses they expect to earn while they hold their current positions, subject to the constraint of avoiding actions which are likely to lead to dismissal.
- (2) Managerial bonuses are a well-defined function of the degree of fulfillment of a small number of specific quantitative plan indicators. Until the recent period,

this function has been highly kinked, with very little or no bonuses being paid for anything less than 100 percent plan fulfillment.

- (3) Annual plan indicators (I_1 and I_2) are set by the authorities at levels which are quite ambitious in relation to the potentialities of a high proportion of enterprises (taut planning). The managers of such enterprises are thus unable to meet these levels except by violating other plan instructions (I_k) to which bonuses are not specifically attached.
- (4) Overfulfillment of plan indicators in one year is followed in the next by the setting of higher planned tasks for the enterprise than it would otherwise have been given.
- (5) Because of this effect of overfulfillment, combined with the kinked nature of the bonus function, managers seek to avoid "too great" overfulfillment in any year and seek to avoid the introduction of new products and processes at their enterprises.

The Soviet approach to managerial incentives is fundamentally the same as the approach developed by Frederick Taylor, at the turn of the century, in regard to manual workers. The incentive problem is perceived as basically that of motivating high effort. Such motivation is best achieved by a composition of earnings which contains a high proportion of income varying in the short term with accomplishments; such accomplishments should be defined objectively and simply so that the income recipient can correctly predict the financial rewards which will accompany greater accomplishments; the financial rewards should be given promptly and fully as soon as possible after the accomplishment is recorded, so that the link between the two is reinforced in the mind of the income recipient. In short, Soviet top managers in enterprises are viewed as responding to incentives in the same fashion as was predicted by Taylor for semiskilled workers. This view seems to have gone virtually unchallenged in the Soviet literature on incentives.

What is, however, regarded as unfortunate in the model is that its incentives lead enterprise managers to press for low annual plan targets and to avoid substantial overfulfillment and innovation. Soviet literature has been filled with complaints of these and other ill effects. The reforms, begun in 1965, have been addressed to many of these issues. Two aspects of the reform specifically directed to the above-mentioned ill effects are the discount on the reward for overfulfillment of enterprise plan targets (the 70 percent rule), and the tying of at least some of the I_1 and I_2 to the five-year plan rather than to annual plan targets for purposes of bonus calculations. The reforms have been revised many times since their original introduction. Under the current version, introduced in 1971-73, each ministry is given a global planned bonus fund for each year of the five-year plan (starting with the 9th Five-Year Plan, 1971-75). These yearly bonus funds are then divided among the ministry's enterprises, primarily in relation to the enterprises' wage funds. In addition to receiving annual planned levels of its bonus fund within the five-year plan period, the enterprise receives annual targets for growth of output and labor productivity, and a planned level of profit rate. As a first step in determining the enterprise bonus fund in any given year during the five-year plan period, the enterprise has the right to alter the annual plans for output, profit rate and labor productivity, and in this way, through an established formula, the level of the planned bonus fund. The actual bonus fund earned in a given year, then, differs from the planned bonus fund in relation to the performance, relative to plan, of profitability, value of sales, and labor productivity:

$$B = \bar{B} + (d_p a_p (p - \bar{p}) + d_s a_s (S - \bar{S}) + d_l a_l (L - \bar{L})) WF.$$

where:

B = Bonus fund, earned

\bar{B} = Bonus fund, planned

d 's = 0.7, if expression in parentheses is > 0 ; and 1.3, if < 0 .

a 's = weights, different for different industries

P = rate of profit, achieved

\bar{P} = rate of profit, planned

S = growth in sales, achieved

\bar{S} = growth in sales, planned

L = growth in labor productivity, achieved

\bar{L} = growth in labor productivity, planned

WF. = Enterprise wage fund, in the year before the five-year plan (1970)

The literature on the reform indicates that approximately 60 percent of the bonus fund is to be determined by profitability, and the remaining 40 percent, by sales (mostly) and labor productivity, and in certain industries, by other indicators. Absolute profit is also important, because contributions to the bonus fund must come from profits. The latter, therefore, set an upper bound to the bonus fund earned in any given year. There are indications in the literature that the extra 30 percent penalty for enterprise plan underfulfillment is calculated on the basis of the original plan rather than the enterprise's "counterplan."

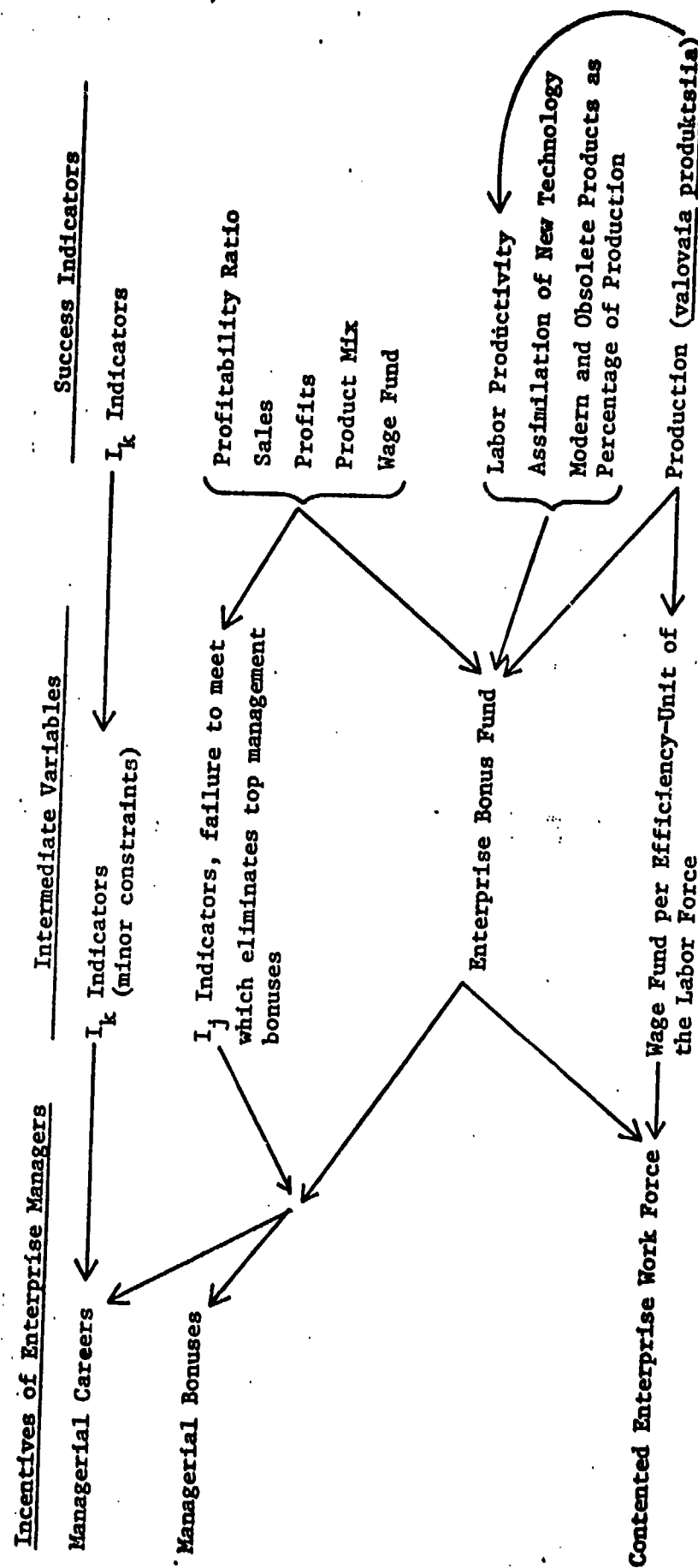
The paper argues that the evidence accumulated so far on the reform does not show much improvement from the 70 percent rule. It is still too early to judge the effects of the other two changes discussed above.

A major problem affecting the implementation of new technology is the incentive for risk taking. In American industry, it is argued, the major incentive for risk taking is the equity stake that top managers have in the firm. In the Soviet Union, no good acceptable substitute for an equity position seems to exist. One possible substitute which could perhaps have a significant incentive effect on risk taking could be promotion. However, from the point of view of effective bureaucratic administration, it might be dangerous to promote bold risk takers to high positions of administrative authority.

By way of summary, Figure 2 depicts the relationships between nine success indicators and the incentives of enterprise managers.

The paper then goes on to examine in detail the effects of six specific factors on the nine success indicators in regard to the assimilation of new technology. This analysis can only be briefly sketched out here.

MANAGERIAL INCENTIVES AND SUCCESS INDICATORS



The first factor is the product-mix plan. Potentially it could bring about the introduction of new products in the enterprise's output mix. Its effect is blunted, however, by the highly aggregative nature of the product definitions used in the product-mix plan. It does not appear to be an important factor in the introduction of new technology.

The second factor is the fund for the assimilation of new technology. Grants from this fund reduce the financial costs connected with the assimilation of new technology borne by the enterprise itself; they thus improve the enterprise's performance as measured by its profitability. However, the data appear to show that enterprises have to cover themselves over half of the full financial costs of the assimilation process.

The third factor is the current-price ratio of new to old products. This ratio is a major factor in regard to the introduction of new products affecting the variables of profitability and value of sales in the enterprise's bonus function. If the current prices of new products are greater than those of old products or if they allow higher profits, the introduction of new products will be encouraged; if the reverse, the introduction of new products will be discouraged. The evidence shows that there is a wide dispersion of these price ratios among industries and enterprises. On balance, it seems likely that the price ratio of new to old products is more often unfavorable to new product assimilation.

The fourth factor, the constant-price ratio of new to old products, is important in the measure of growth of output, since this index is measured in constant prices. This factor also varies among industries. In the key machine-building sector, however, it has a decidedly negative effect on the introduction of new products, and thus on those new processes embedded in new machinery products. This is because of the following. The constant price of new machines is set on the basis of the current price of comparable existing products. And while there are those who argue that machinery prices continued to rise even after 1967, it is argued here that there is

evidence to support the official price index, after 1967, which shows a fall in machinery prices. With such a fall, the "constant" new product price will tend to be lower than the constant (1967) old product price. Therefore, the introduction of a new product will depress the rate of growth of gross output achieved by the enterprise (which still plays an important role in bonus determination).

The fifth and sixth factors are the degree of modernity of products and processes. In this regard, mention should be made of the bonuses paid for development and assimilation of new technology. These bonuses, however, have in recent years accounted for only 2 percent of total bonuses in industry and perhaps 10 percent in machine-building. In addition, more than half of the money paid into the bonus fund for the assimilation of new technology has gone unused or has been spent for purposes other than bonuses.

Figure 3 depicts the relationships between the six factors and the nine success indicators.

The conclusions as to the effects of incentives on the degree of assimilation of new technology are summarized in Figure 4. They are as follows:

- (1) New products which represent major changes from products earlier produced by the enterprise: the net incentive effect is decidedly negative.
- (2) New products which represent minor changes: the net incentive effect will differ among enterprises, but on balance it is almost certainly negative in the machine-building branch. Though here, the I_k indicator of the proportion of new products to total production will, when the I_1 and I_j incentive effects are only mildly negative, lead managers to introduce new products, in consideration of career objectives.

Figure 3

FACTORS AFFECTING MAJOR SUCCESS INDICATORS

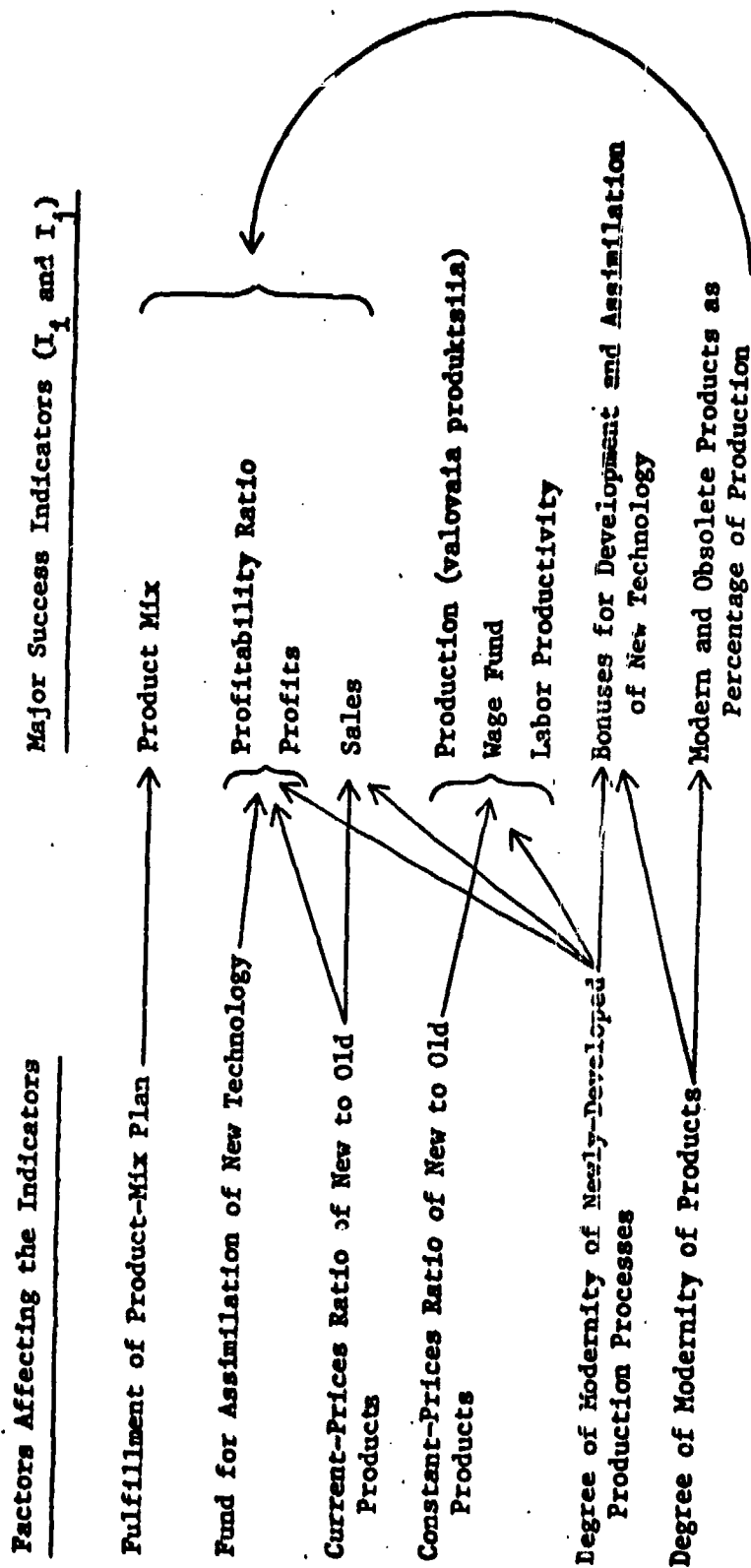


Figure 4

EFFECT OF DIFFERENT TYPES OF ASSIMILATION OF NEW TECHNOLOGY
ON THE MAJOR SUCCESS INDICATORS OF THE PRODUCTION ENTERPRISE

Types of Assimilation of New Technology				Major Success Indicators (I ₁ and I _j)
New Products, Major Changes from those Earlier Produced	New Products, Minor Changes from those Earlier Produced	New Processes, Major Changes from those Earlier Employed	New Processes, Minor Changes from those Earlier Employed	
-	? (mostly -)	-	+	Profitability Ratio Sales Profits
-	? (mostly -)	-	+	
-	? (mostly -)	-	+	
-	-	-	+	Production (vallovaia produktstva) Wage Fund Labor Productivity
-	-	-	+	
-	-	-	+	
+	no effect	no effect	no effect	Product Mix
+	+	+	+	Bonuses for Assimilation of New Technology Modern and Obsolete Products as Percentage of Production
+	+	no effect	no effect	
+	+	no effect	no effect	

Code: + Positive effect of the particular type of assimilation on the specific success indicator
- Negative effect of the particular type of assimilation on the specific success indicator

- (3) New processes which represent major changes: the net incentive effect on this type of technology assimilation appears to be more negative than for any other type of assimilation. It should be noted, though, that major new processes do get introduced into Soviet industry through the means of new investment projects where, of course, the enterprise incentive issues under discussion do not apply.
- (4) New processes which represent minor changes: this is the only type of technology assimilation for which enterprise managements have a strong net positive incentive. Thus the model tells us that process improvement in existing Soviet enterprises should not be dramatic, that it should generally remain within the compass of the existing broad technological processes currently in use, and that process improvement in Soviet enterprises should be more evolutionary than is the case in dynamic capitalist enterprises.

IV THE EAST GERMAN INCENTIVE MODEL

In the paper's discussion of the Soviet incentive model and its negative effect on the introduction of new technology, the problem was not so much with the individual success indicators as with the basic reward-punishment model itself. Is this model inherent in a centralized socialist system, and thus alterable only through radical change of an ideological nature? An investigation of East German managerial experience suggests the contrary. The East Germans have been relatively successful in assimilating new technology and yet ideologically their patterns of managing industry do not differ significantly from those of the Soviet Union. But they do operate under a substantially different management philosophy.

A model of managerial behavior in East Germany is presented in some detail in the paper. This indicates, first of all, that managerial career movement in the GDR is quite pronounced both in terms of promotion and demotion. Thus, contrary to postwar Soviet experience, incentive factors affecting managerial careers are important in East Germany.

Secondly, bonuses for top management in East German industry are not determined by actual compared to planned performance of the enterprise according to a limited number of specified and weighted success indicators. Instead, they are determined and paid, completely subjectively, by managerial superiors above the level of the enterprise. In this regard, East Germany follows the American practice for rewarding divisional managers.

Thirdly, the issue of plan tautness is quite different in the GDR from what it is in the Soviet Union. This is indicated by the fact that only an insignificant number of East German enterprises fail to meet their major plan targets, and also very few of them overfulfill. The pressure of taut plans is not used. East German enterprises strive for simple plan fulfillment of major I_1 and I_2 indicators, and use their reserves for meeting the

I_k indicators, which are often nebulous but which have important career effects. Managers of East German enterprises "satisfice" with regard to meeting their stated plan objectives, i.e., they make no efforts to exceed them. Such a model can operate only if the critical plan objectives are set at less than a taut level. Furthermore, the satisficing model requires that managerial reward not be attached to the degree of success in overfulfilling plan indicators.

In both American corporations and in East German industry, career incentives are of prime importance, and these are almost necessarily subjective. In addition, managerial bonuses are determined on essentially subjective grounds.

It is the argument of the paper that the difference in the degree of success of East German and Soviet enterprises in assimilating new technology rests upon the comparison of their general incentive models. Operating within a satisficing model framework, East German managers are able to give a degree of emphasis to new product development and assimilation into production which cannot be expected from their Soviet counterparts who operate within a clearly defined, taut, constrained maximization incentive model. Moreover, the foreign trade position of the GDR provides its leaders with a particularly strong motive for encouraging such emphasis.

V POSSIBILITIES OF IMPROVEMENT IN SOVIET ASSIMILATION OF NEW TECHNOLOGY

Before exploring the possibilities of improvement in Soviet assimilation of new technology, the paper mentions two major obstacles in the Soviet economy to the introduction of new technology. One is the presence of sellers' markets in the vast majority of products of Soviet industry. Given a general sellers' market, enterprises are not compelled by the pressure of competition to introduce new technology. They are shielded from what is perhaps the main force leading to the diffusion of new technology in developed capitalist countries. The second obstacle is the absence of a really powerful reward for risk taking because of the unavailability for managers of any equity ownership in their enterprises.

What are the possibilities for improvements in Soviet assimilation of new technology? To begin, while there does not seem to be much that can be expected in regard to equity involvement for Soviet managers, Soviet leaders could reduce the level of excess demand in the Soviet economy and thus reduce the presence of sellers' markets.

In regard to some of the issues discussed earlier, some changes might be expected.

A. Organization

The 1974 decree concerning the future reorganization of the associations (ob'edineniia), transforming them into genuinely unitary organizations, offers the promise of bringing the Soviet organizational relationship between advanced development, design, and production into line with the pattern dominant in the West and, perhaps, also in the GDR. Certainly, if this transformation is realized, it will provide the potential for significant advantages in the technological assimilation process. Nevertheless, whether the net advantage will be substantial, or even positive, is debatable. Given

the current Soviet incentive pattern which leads top management to emphasize short-run results, the effect of such a change might even be to weaken temporarily the Soviet technology development effort.

B. Proportional Inputs in Different Forms of R&D

A reduction in the current disproportion among different stages in the R&D chain, which exists both in respect to the West and to the ideal of most Soviet writers on the subject, seems to be the change which is the most likely to occur. This would be in the direction of a reversal of the current proportions of expenditures on applied research as compared with engineering and design. Such an improvement in the relative sizes of the different links in the process might substantially increase the effectiveness of the Soviet R&D effort, but only insofar as this is embodied in final product and process design and in experimental models. It is irrelevant to the problems of assimilation of such design into actual production.

C. Importation of Foreign Technology

It seems reasonable to predict the continued importing of foreign technology into the Soviet Union. But the author also predicts a low benefit-cost ratio to such imports. So long as Soviet leaders remain unwilling to accept equity investment and/or massive two-way flows of technologists, foreign technology will continue to be absorbed in an inefficient fashion. However, there are indications of growing Soviet interest in developing alternative arrangements for industrial cooperation with foreign firms which will serve as more adequate substitutes for outright foreign equity investment in the Soviet Union.

D. Specific Forms of Success Indicators

A major approach to the improvement in Soviet technology assimilation has been through the modification of specific forms of success indicators, cost sharing and pricing devices, and temporal range of plans against which

enterprise results are evaluated. It is safe to predict that these modifications will continue. But it is the thesis of this paper that such cosmetic changes in the managerial incentive model will not have any very major effect either for good or for bad.

E. Adoption of the East German Management Model

Finally, what are the possibilities that Soviet leaders might adopt the East German approach to managerial incentives? Such a shift would involve a basic change in Soviet managerial philosophy. While such philosophy has nothing to do with Soviet ideology, and perhaps even has little significance for basic power relations within the Soviet middle or upper leadership ranks, it may be nonetheless resistant to change. In fact one might even argue that the current managerial philosophy may be as resistant to change in the short- or medium-run as is ideological philosophy. This is especially so when the attitudes implied in the Taylorism reference made above are taken into consideration. The fact that Soviet leaders treat top management in Soviet industry in the ways that Taylor prescribed for semiskilled workers indicates the low confidence they have in Soviet managers' judgment and capacity for independent action.

Furthermore, there is nothing in either the Soviet or East German literature to indicate recognition in either country that the managerial incentive systems of the two nations are fundamentally different.

Nevertheless, it would appear that major improvement in Soviet assimilation of new technology could be achieved if Soviet industry were to adopt the American-GDR model. With the strong current interest in management techniques which exists in the USSR, one should not write off the possibility that interest in techniques may broaden to interest in philosophy.